

What is claimed is:

1. A vehicle electrical system, comprising:

an alternator;

a controllable voltage regulator coupled to the alternator for energization;

a battery connected to the controllable voltage regulator for charging;

a battery temperature sensor providing measurement signals of battery temperature;

a current sensor coupled to a terminal of the battery for providing signals relating to current drawn and supplied to the battery; and

data processing means connected to receive the measurement signals of battery temperature and the signals relating to current drawn and supplied to the battery and responsive thereto for generating a control signal for the controllable voltage regulator.

2. A vehicle electrical system as set forth in Claim 1, further comprising:

a low voltage accessory circuit; and

a low voltage regulator connected to the alternator for energization and to the low voltage accessory circuit to supply power thereto.

3. A vehicle electrical system as set forth in Claim 2, further comprising a high voltage component circuit.

4. A vehicle electrical system as set forth in Claim 3, wherein the data processing means further comprises:

means for accumulating a measurement of current discharged from the battery; and

means responsive to the measurement of current discharged from the battery for generating the control signal applied to the controllable voltage regulator.

5. A vehicle electrical system as set forth in Claim 4, wherein the means for generating the control signal is further responsive to measurements of battery temperature.

6. A vehicle electrical system as set forth in Claim 5, wherein the data processing means further comprises:

a clock;

means responsive to the clock and to the temperature measurements for calculating the time rate of change of battery temperature; and

the means for generating the control signal being further responsive to the time rate of change of battery temperature for setting the control signal to limit the voltage level provided by the controllable voltage regulator.

7. A vehicle electrical system as set forth in Claim 6, wherein the data processing means further comprises:

means for measuring total current into the battery; and

means responsive to measured battery temperature and measured total current for estimating loss; and

means for setting the control signal being further responsive to the measurement of total input current and estimated loss for setting voltage from the controllable voltage regulator to allow float charge of the battery upon determination that the battery is fully charged.

8. A vehicle electrical system as set forth in Claim 7, further comprising two batteries, one charged at first voltage and the second charged at a second voltage.
9. A vehicle electrical system as set forth in Claim 7, further comprising a high voltage regulator connected to the alternator for energization and to the high voltage component circuit to supply power thereto.
10. A vehicle electrical system, comprising:
  - a lead acid battery having two terminals;
  - a current sensor coupled to one terminal of the battery for measuring current sourced from and delivered to the battery;
  - a temperature sensor proximate to the battery for measuring battery temperature;
  - a charging regulator responsive to a control signal and having input and output terminals, connected by the output terminal to one terminal of the battery for controlling current delivered to the battery;
  - an electrical system controller responsive to the measured current sourced from the battery and the measured battery temperature for generating the control signal applied to the charging regulator; and
  - an energization source connected to the input of the charging regulator.

11. A vehicle electrical system as set forth in Claim 10, further comprising a second lead acid battery charged at a different voltage than the first, the charging regulator being adapted to provide charging across two circuits.
12. A vehicle electrical system as set forth in Claim 11, wherein the electrical system controller includes means for totaling the measured current sourced from the batteries.
13. A vehicle electrical system as set forth in Claim 12, and further comprising:
  - a lighting system circuit; and
  - a lighting system voltage regulator connected between the energization source and the lighting system circuit.
14. A vehicle electrical system as set forth in Claim 13, wherein the electrical system controller further comprises:
  - means for profiling anticipated continuous run time for an engine after engine starts; and
  - means responsive to anticipated continuous run time for adjusting control signals applied to the charging regulator.
15. A vehicle electrical system as set forth in Claim 14, wherein the electrical system controller further comprises:
  - diagnostic means for estimating battery internal resistance;
  - means for estimating battery internal losses during charging; and

means responsive to estimated internal losses of the batteries for adjusting the control signals applied to the charging regulator.

16. A vehicle electrical system comprising:

a battery set having a grounded terminal and an ungrounded terminal;

an electrical system controller including data processing capacity;

a charging regulator having an output connected to the ungrounded terminal of the battery and a control input;

an electrical power generator connected to energize the charging regulator;

instrumentation connected to the electrical system controller for providing measurements of current discharged from the battery, current delivered to the battery, and battery temperature;

a program residing on the electrical system controller for execution, the program utilizing battery temperature, battery temperature rate of change and measured current discharged as inputs to an algorithm for dynamically setting a control signal value; and

means for applying the control signal to the control input of the charging regulator.

17. A vehicle electrical system as set forth in Claim 16, further comprising:

a plurality of electrical subsystems for supplying power to different component groups of the vehicle; and

a voltage regulator for setting the voltage on selected electrical subsystems independently of the other electrical subsystems.

18. A vehicle electrical system as set forth in Claim 17, further comprising:

a second battery set connected to provide power at a different voltage than the first battery set.